

REMARKS

Applicant requests favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 27-50 are presented for consideration. Claims 27, 36 and 47-50 are independent. Claims 27, 33, 34, 36, 42, 43, 45 and 47-50 have been amended to clarify features of the subject invention. Support for these changes can be found in the application, as originally filed. Therefore, no new matter has been added.

Applicant requests favorable reconsideration and withdrawal of the rejections set forth in the Office Action.

Claims 27-50 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 5,760,878 to Ogushi. Applicant submits that this patent does not teach many features of the present invention as previously recited in these claims. Therefore, this rejection is respectfully traversed. Nevertheless, Applicant submits that independent claims 27, 36 and 47-50, for example, as presented, amplify the distinctions between the present invention and the cited art.

In one aspect of the invention, independent claim 27 recites an apparatus for determining a position of a mark on an object placed on a stage. The apparatus includes an image sensing system which obtains image data by sensing an image of the mark, a measurement system which measures a position of the stage plural times during the sensing of the image of the mark by the image sensing system, and an arithmetic section which calculates the position of the mark based on the image data obtained by the image sensing system and the positions of the stage measured by the measurement system.

In another aspect of the invention, independent claim 36 recites an exposure apparatus comprising a stage on which a substrate is placed, a lens section which projects a pattern onto the substrate, a first measurement system which measures a position of a mark formed on the substrate, a second measurement system which measures a position of the stage plural times during the measurement of the position of the mark by the measurement system, and a calculation section which calculates the position of the mark based on a measurement result by the first measurement system and measurement results by the second measurement system, and a positioning system which drives the stage based on the position of the mark calculated by the calculation section.

In still another aspect of the invention, independent claim 47 recites a method for determining a position of a mark on an object placed on a stage. The method comprises steps of first measuring a position of a mark formed on the object, second measuring a position of the stage plural times during the measurement of the position of the mark in the first measuring step, and calculating the position of the mark based on a measurement result in the first measuring step and measurement results in the second measuring step.

In yet another aspect of the invention, independent claim 48 recites a method adapted for an exposure apparatus having a stage on which a substrate is placed, and a lens section which projects a pattern onto the substrate, the method comprising steps of first measuring a position of a mark formed on the substrate, second measuring a position of the stage plural times during the measurement of the position of the mark in the first measuring step, and calculating the position of the mark based on a measurement result in the first measuring step and measurement results in

the second measuring step, and driving the stage based on the position of the mark calculated in the calculating step.

In yet another aspect of the invention, independent claim 49 recites a method of manufacturing a device, using an exposure apparatus having a stage on which a substrate is placed, and a lens section which projects a pattern onto the substrate, the method comprising steps of placing the substrate applied with a resist on the stage, first measuring a position of a mark formed on the substrate, second measuring a position of the stage plural times during the measurement of the position of the mark in the first measuring step, and calculating the position of the mark based on a measurement result in the first measuring step and measurement results in the second measuring step, aligning the substrate using the stage in the exposure apparatus based on the position of the mark calculated in the calculating step, and transferring a pattern to the substrate using the lens section.

In still another aspect of the invention, independent claim 50 recites an apparatus for determining a position of a mark on an object placed on a stage, the apparatus comprising a first measurement system which measures the position of the mark, a second measurement system which measures a position of the stage plural times during the measurement of the position of the mark by the first measurement system, and a calculation section which calculates the position of the mark based on a measurement result by the first measurement system and measurement results by the second measurement system.

Accordingly, the present invention provides the ability to calculate a position of a mark on an object (such as a substrate) based on image data (such as a measurement result) obtained

by an image sensing system (such as a first measurement system) and positions of a stage measured by a measurement system (such as a second measurement system) plural times during the image sensing by the image sensing system. Applicant submits that the cited art does not teach or suggest such features of the present invention, as recited in the independent claims.

The Ogushi patent is directed to an exposure apparatus in which information representing a relative positional deviation between an original and a wafer is produced and error shot discrimination is made based on that information. The Ogushi patent, however, fails to teach or suggest that a position of a mark formed on a wafer is calculated based on image data of the mark on the wafer placed on a stage and positions of the stage measured plural times during the image sensing for obtaining the image data of the mark, in the manner of the present invention recited in the independent claims.

In the embodiment shown in Figure 5 of the Ogushi patent, an auto-alignment unit 510 detects a positional deviation between a reticle 502 and a wafer 103 by using a pickup 504. This arrangement in the Ogushi patent, however, does not teach or suggest that a mark position of the wafer 103 is calculated based on image data of the mark obtained by the pickup 504 and positions of the stage measured plural times during the image sensing for obtaining the image data of the mark. That is, the device shown in Figure 5 of the Ogushi patent does not take stage positions during the image sensing for taking the mark image into consideration for calculating a mark position.

In the embodiment shown in Figure 7 of the Ogushi patent, the laser distance measuring devices 106, which measure the reticle stage 701 and the wafer stage 101, are used to detect a

positional deviation between the reticle 502 and the wafer 103. Figure 7 also shows the pickup 504 discussed above. Applicant submits, however, that the embodiment shown in Fig. 7 of the Ogushi patent likewise does not teach or suggest that a mark position of the wafer 103 is calculated based on image data of the mark on the wafer 103 and positions of the wafer stage 101 measured plural times during the image sensing for obtaining the image data of the mark. Rather, in the device in that patent, the position of the wafer stage 101 is merely used for calculating a positional deviation between the reticle 502 and the wafer 103.

Applicant submits, therefore, that the Ogushi patent does not teach or suggest using the image sensing system (pickup) and the wafer stage position measuring system laser distance measuring device for determining a position of a mark on an object placed on the wafer stage. Applicant further submits that the Ogushi patent does not provide any motivation to calculate a position of a mark based on image data obtained by an image sensing system and positions of the stage measured by a measurement system plural times during the image sensing by the image sensing system, in the manner of the present invention recited in the independent claims.

Still further, the error shot discrimination in the Ogushi patent is conducted after completion of transferring a pattern to a wafer, based on positional deviation between the reticle and the wafer during exposure. Generally speaking, it is not necessary to obtain a position of a mark on a wafer during an exposure period (after starting the exposure period). Rather, determining the position of the mark of the wafer is necessary to align the reticle and a wafer before starting the exposure period. Thus, Applicant submits that there would have been no motivation to modify the device in the Ogushi patent so as to detect a position of the mark on the

wafer, instead of the positional deviation for the error shot discrimination by using the pickup and the laser distance measuring device.

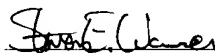
For the foregoing reasons, Applicant submits that the present invention, as recited in independent claims 27, 36 and 47-50, is patentably defined over the cited art.

Dependent claims 28-35 and 37-46 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the objection and rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,



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